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Summaries of Addresses of Presidents of Sections

BOTANY

President: PROF. YAJNAVALKYA BHARADWAJA, M.Sc., PH.D., F.L.S.

SOME ASPECTS OF THE STUDY OF MYXOPHYCEÆ

MYXOPHYCEÆ as a group form one of the most primitive groups of plants retaining their evolutionary lag. They are characterised by the possession of the blue green pigment, and the absence of any definite motile bodies, chromatophores, or reproductive organs. They form the chief constituent of planktons or 'water blooms' both of marine and fresh water. For the luxurious development of the plankton, various edaphic factors are responsible, such as light, temperature (upto 18–22°), and chemical substances produced by the decomposition of organic matter and dissolved carbonates of magnesium and calcium.

Many species of Myxophyceæ are present in plankton, and among these are forms like Microcystis, Chroococcus, Coleosphaerium, Spirulina, Ocillatoria, Anabæna, Nostoc, Nodularia, Aphanizomenon, Rivularia and others. In some cases on account of their abundance they give the characteristic hue to the landscape, as *Ocillatoria erythræa*, which is responsible for the red colour of the water in Red Sea. Ph value of water which is influenced by stagnation and other factors, also influences the growth of the algæ.

In ponds where the water is used for domestic purposes, the development of these blue-green algæ is nauseating. It produces nasty odours, and on account of synthesis of various kinds, produces toxic substances, and harbours many kinds of bacteria. Gillam, Fitch and others have shown, that mortality in some of the domestic animals is caused by the use of water containing Cyanophyceæ like *Microcystis flos-aquæ*, *Anabæna flos-aquæ* and others. *Lyngbya majuscula* is said to cause the death of horses feeding upon them. Fishes feed upon many of the algæ growing in ponds. But when there is a thick growth of algæ death of many fishes such as trouts has been reported, on account of oxygen exhaustion in the water during nights. It has been suggested that by the use of copper sulphate, and sodium arsenite in known quantities, the algæ can be effectively controlled without killing the fishes.

Many of the Myxophyceæ are the first plant forms to grow in the soil, and form substrata and manure for the growth of higher plants. Prof. Fritsch demonstrated the fixation of nitrogen by forms like *Anabæna gelatinosa*, and *A. naviculoides*, resulting in the increased fertility of the soil in rice fields.

The demarcation between the various genera and species is very confusing on account of the presence of a number of inter-grading species. Ecological study of the forms must be surely taken into account before classification is studied.

Prof. Bharadwaja gives an account of the structure and development of heterocysts, and also of the various views regarding their nature. They are said to be of the nature of reserve substances, bodies limiting the length of filaments, structure helping in hormogone formation, archaic reproductive bodies, and receptacles for enzyme, responsible for the development of gas vacuoles. Perennation in non-spore forming forms is described. In forms like *Scytonema geitleri*, and *Fischerella anomala* development of hormocysts for perennation occurs.

Cytology of Myxophyceæ is very problematic. The nature of the incipient nucleus is not clearly understood. Mitosis during cell division is absent. The 'Chromidial apparatus', which is the central region in the cell giving reactions to nuclear stains, lacks a well-defined nuclear membrane.

The resemblance between Myxophyceæ and thread bacteria is pointed out. They are grouped under Schizophyta by Cohn. The mucilaginous sheath of Tolypothrix and Cladothrix, and the oscillating movements of Ocillatoria and Beggiatoa are very striking, and point out their close resemblance. But there is no similarity between these organisms, when the structure of the cell wall is considered.

ENTOMOLOGY

President: Dr. Hem Singh Pruthi, M.Sc., Ph.D., F.N.I.

ECOLOGY AND CONTROL OF INSECTS

THE study of organisms in relation to their environment as affecting insect pests of crops, has, of late, assumed an ever-increasing importance. Knowing accurately the conditions of environment of injurious insects, we can investigate the possibilities of changing their whole economy in our favour. In a number of cases, it is now possible to predict their outbreak and thus the cultivators are in an advantageous position, to devise suitable measures for controlling the pests as soon as they appear.

The three classes of elements comprising the environment of insects are (1) Media (water, soil, air), (2) Factors (light, heat, humidity, parasites and predators), (3) Controls (topographic or climatic). Our pests being mostly terrestrial, water, as a medium of environment, has been omitted from the scope of this discourse.

Of the various factors of environment, namely, light, temperature, humidity, rainfall, atmospheric pressure, and air currents, light is the greatest single source of energy for almost all biological systems. Light, as an ecological factor, has been defined as all short wave-lengths of radiant energy, upto and including the visible spectrum. The effect of sunlight and ordinary daylight, on the flight and reproductive activities of various insects of economic importance has been too apparent to need emphasis. Artificial sources of light, too, are continually being made use of in destroying injurious insects all over the world. Certain experiments of Chapman on *Tribolium confusum*, and of Northrop on Drosophila, however, point towards the importance of the influence of light, not being quite conclusive.

One of the fundamental necessities of insects is to maintain a proper balance between the moisture content of their bodies and that of their environment. The distribution and abundance of insects is, therefore, profoundly influenced by the range of humidity present in different regions.

The influence of rainfall, as an ecological factor, is closely related to that of humidity; in fact, the latter is dependent on the former. The abundance of insects as well as the possibility of their control, in a tract, is affected not only by the total amount of rainfall, but also by its distribution in time.

In nature, the effects of temperature and humidity are very much dependent on each other. They vary together and roughly do so reciprocally. The same intensity of heat may affect an insect according to the moisture content of the air which, in itself, depends upon temperature, especially when it is high. It has been found that there is a definite zone of optimum combination of temperature and humidity and that fluctuations of either factors from the optimum are injurious to the insect pests. The best available index for expressing the influence, particularly of temperature and humidity, is the evaporating power of the air, and the saturation deficiency, rather than the relative humidity of the air. Insect behaviour in many cases, is closely correlated with the saturation deficiency of the atmosphere.

Insects are able to endure far greater variation of barometric pressure than are normally found on the surface of the earth, and therefore, atmospheric pressure does not appear to be an ecological factor of much significance. It should, however, be kept in view while evaluating the influence of physical factors on insect activity.

Ecological studies are fully justified, as they help us in forecasting of insect outbreaks, and their relative abundance, as well as in affording us information about the vulnerable points in the bionomics of insects, which can form bases for their practical control. In fact, in ecological or natural methods of control, there appears to be a potential solution of many entomological control problems.

ANTHROPOLOGY

President: Rao Bahadur K. N. Dikshit, M.A., F.R.A.S.B.

SCOPE OF PREHISTORIC AND ANTHROPOLOGICAL WORK IN INDIA

IN his Presidential Address, Rao Bahadur K. N. Dikshit draws attention to the intimate connection of archæology with anthropology; Sir Leonard Woolly has drawn pointed attention to the absence of *sufficient* contact between the Archæolcgical Departmcnt and Anthropologists in India and has stressed the necessity for close contact among the workers interested in these two fields of scientific research. A common plan may result in a more intelligent collection of anthropological material, and the task of archæologists will be rendered simpler if the museums were to collect and preserve not only ancient pottery and handiwork, but also those produced by primitive peoples of the present day. For extending the scientific activities in prehistoric archæology and anthropology more workers are required. The need for organising this is very urgent, as the pace of advancing civilization may wipe out ancient ruins and the primitive tribes who are giving up their old ways of living.

Rao Bahadur K. N. Dikshit then refers to the pioneering work of Bruce Foote in the field of prehistoric archæology and the important results obtained by him concerning the sequence of palæolithic and neolithic cultures. He cites the example of the systematic survey made by the Yale-Cambridge Expedition led by Dr. De terra in the Sohan Valley in the North Punjab and the valley of Kashmere and the unfolding of the existence of a palæolithic culture between the Indus and the Dhebu. Mention is made of the most interesting and well-developed phase of prehistoric civilization of India in Harappa

and Mohenjo Daro and the discovery of skeletal material which may throw further light on the racial character of the Indus people. The necessity for research to ascertain the sequence of metallurgical knowledge in India is also pointed out.

The Rao Bahadur then commends the study of megalithic monuments in regions occupied by the primitive tribes from Assam to the Malabar coast and the unlimited scope for work in South India owing to the abundance of material for manufacture of tools suitable for palæolithic and neolithic man. He hopes that the Government of India would implement the recommendation of Sir Leonard Woolly that two protohistorians may be appointed at once to tackle such problems. The need for a Physical Anthropologist on the staff of the Archæological Department is then stressed. He also commends anthropometric work and suggests that the only way in which large-scale measurements can be undertaken would be to make it part of the Census operations and that Universities and learned bodies should undertake the work. Lastly, he invites attention to the collection of anthropological material from ancient records dealt with by Indian Epigraphists and sums up by an appeal for attention being diverted to these long-neglected studies.

ZOOLOGY

President: PROF. B. K. DAS, D.Sc. (LOND.)

NATURE AND CAUSES OF EVOLUTION AND ADAPTATION OF THE AIR-BREATHING FISHES

UNTIL quite recently, comparatively very little was known about the habits, structure, development and physiology of a very interesting group of certain curious, amphibious, tropical fishes, mostly confined to fresh water and distributed over distant parts of the world. These fishes have a double mode of respiration owing to the possession of some kind of special adaptational structures known as the accessory air-breathing organs or *lungs* in addition to the gills: they can either normally breathe the oxygen dissolved in the water by means of their gills so long as they are in water, or the atmospheric air directly under certain special circumstances, as when they occasionally leave their natural abode. The adaptation that is most commonly met with amongst the Indian fishes takes the form of certain specialised receptacles or chambers lying above the gills, which are therefore called the suprabranchial air-breathing chambers [*e.g.*, the snake-headed "walking fish" (*Ophicephalidæ*), certain catfishes (*Clarias* and *Saccobranchus*), the so-called Climbing Perch of India (or the famous 'Koi' fish of Bengal—*Anabas scandens*), the Cuchia "eel" (*Amphipnous cuchia* = the 'Koonchey' fish of Bengal), etc.]. Besides, several other extremely interesting adaptations and modifications have been described in the address.

Dr. Das has investigated and given a complete account of the structure, development and physiology of these interesting adaptations in the majority of the Indian air-breathing fishes.

Broadly speaking, all the air-breathing fishes of India are found in practically all kinds of waters, and fall under three main habitat-groups, *viz.*:

I. *The Tropical Fresh-water Group*, including those mostly found in tropical pools, muddy water, swamps, tanks, ponds, ditches, smaller streams, etc. [*e.g.*, *Ophiocephalidæ*; *Clarias*; *Saccobranchus*; *Anabas* (and other *Anabantidæ*); an intestinal-breathing loach called *Lepidocephalus*, etc.] A few in marshes, swamps and muddy banks also (*e.g.*, *Amphipnous* = *semi-terrestrial and most advanced and best evolved air-breather amongst the Indian Teleosts*).

II. *The Tropical Brackish and Estuarine Waters Group*, including the coastal, estuarine and brackish water species (*e.g.*, a brackish water eel, *Pisoodonophis boro* and a Gobiid, *Pseudapocryptes lanceolatus*); others on the shores and mud-flats of these waters, *e.g.*, the "Walking Goby" or Mud-skipper = *Periopthalmus*—a *semi-terrestrial* fish, mostly found on mud-flats, and very cunning in its movements, showing very characteristic twitching movements of the eyes; the supposed breathing by means of the tail region in this fish is an entirely false notion. *Boleophthalmus* skims over the surface of water very rapidly in a serpentine manner.

III. *The Tropical Marine Group*, including the "Rock-skipper" (*Andamia heteroptera*—a Blenniid, which lives on rocks beyond the surf line), and a few other coastal Blenniids and some other coastal fishes also.

In all, *as a result of response to the direct effects of environment*, chiefly due to the lack of oxygen in the surrounding medium, Dr. Das has described six main types of these beautiful structural adaptations or "lungs" which have evolved in the different groups of fishes, which are, as a rule, distantly related to one another. This series of adaptations illustrates one of the finest examples of what is known as "parallelism in Evolution".

Starting from a simple and most primitive vascularised bucco-pharyngeal epithelial surface for aerial respiration, Dr. Das has carefully traced the successive stages in the evolutionary adaptational modifications leading to complicated air-breathing structures, involving corresponding alterations in the gills and the alimentary canal and in the vascular system. This section forms the most important part of his investigations covering an extensive field of enquiry and patient work.

From his studies Dr. Das concludes that the accessory respiratory organs in fishes are chiefly concerned with oxygen absorption, whereas the gills are the principal organs for the excretion of CO_2 (except *Hypopomus* and probably *Symbranchus*, where the gills also partly subserve aerial respiration in addition to their normal function of aquatic respiration).

MEDICAL AND VETERINARY RESEARCH

President: DR. J. P. HADDOW, B.Sc., M.R.C.V.S., D.V.S.M.

THE DEVELOPMENT OF ANIMAL HUSBANDRY IN INDIA

OWING to the varied climatic and geographical conditions in India, a wide range of animals, such as, elephants, camels, horses, cattle, buffaloes, sheep and goats came under man's domestication. In the maintenance of these varied species as well as their development, various factors have played a great part from time to time, the foremost among them being the problems of famine and disease. The presence or absence of disease or famine have been the main, if not the exclusive, controlling forces in the development of Animal Husbandry in this country. This also explains why, in matters of live-stock, quality was being subordinated to quantity in this country, the numbers serving as the only effective insurance for the husbandman against the ravages of animal diseases caused by several agencies, *e.g.*, Viruses, Bacteria, Protozoa and Parasites.

The means for the prevention of any disease must have a cash value commensurate with the value of the animal protected and must, therefore, in the beginning be exceedingly small. The so-called Serum simultaneous method of inoculation, for instance, against Rinderpest, although indisputable in its efficacy, had not been of much success as it costed a rupee or more per head. This problem was solved, thanks to the endeavours of Dr. Edwards, fifteen years ago by the evolution of a cheaper method of vaccinating cattle with a strain of virus fixed in goats. Difficulties in the progress of control of other virus diseases, *viz.*, foot and mouth disease of cattle, pox of animals and poultry, Ranikhet disease of poultry, etc., could, with the exception of foot and mouth disease, largely be attributed to the lack of accurate diagnosis and want of suitable specific methods of controlling them. Till recently the extent to which virus infections might be responsible for wastage had not been fully realised.

Under Bacterial diseases, the greatest damage was caused by Pasteurelloses. The use of antiserum and a vaccine for the control of actual outbreaks of these had been reported to be uniformly successful with, perhaps, a few exceptions. Further important developments might accrue from careful research into the factors controlling the distribution and the incidence of these conditions. More precise information is also necessary on the epizootology of Anthrax and Black-quarter, if full advantage is to be taken of the remedial measures available. Organised measures for the diagnosis and control on a large scale in India have yet to be made, on diseases like Contagious abortion, Tuberculosis, Tchne's disease, etc.

Of the Protozoal diseases, Piroplasmosis of cattle and Trypanosomiasis of horses and camels and Spirochætosis of fowls stand out prominent. These could not be properly considered without reference to their insect vectors, and in all these cases the eradication of the vector rather than the control of the parasite must be the objective. Suitable measures are known for the reduction of wastage due to parasitism such as that carried on by Warble fly larvæ, Tick infestation and depradation of biting flies.

Proceeding to the second main factor, namely, famine, the problem was now slowly changing from one of total famine to several of partial famines, particularly of "Individual essential ingredients in the diet". Malnutrition was evident everywhere and it was gratifying to note that the danger had been realised and necessary steps were now being taken. The provision of well-balanced supplies of food represents a real economy, not only because of increased production but also by increasing the resistance to disease and parasitic infestation.

As time advanced, interest in quality rather than the quantity of stock was bound to become more general. The development from this point onwards depended upon our increasing knowledge of the science of Genetics. At one end of the scale was milk and at the other end draught. Whether it was possible to combine milk production with the capacity for fast work remained to be seen. On the side of milk production the development of the buffalo had to be considered. In the case of the sheep the objectives must be first to investigate the possibility of wool, mutton and transport separately before attempting to combine them indiscriminately. While the goat could exist and produce "a modicum of milk" where the cow would starve, there was the question of damage caused to the shrubs to be considered and, if allowed unrestricted range, this species might become a nuisance to those engaged in fighting soil erosion. Finally the education of the husbandman himself should not be overlooked. "As with his animals, so he himself must have a fair insurance against famine and disease if he is to take an active part in the development of the industry which he controls".

P. M. N.

AGRICULTURE

President: PROF. JAI CHAND LUTHRA, M.Sc., D.I.C., I.A.S.

SOME PROBLEMS OF CROP PRODUCTION IN INDIA

THE main theme of the Presidential Address of the Session is the importance of seed as a factor in crop production, though numerous other problems of a somewhat familiar character, both scientific and economic, are also dealt with. The indifference of the farmer to the importance of seed is one of the chief causes responsible for the set-back to agriculture, notwithstanding the existence of the general belief in good seed as evidenced by the practice of prudent farmers everywhere and of proverbs current inculcating the value of such seed. Work in India on the different aspects of this problem is reviewed. Viability trials by Sonave of one to ten-year old seeds of sixteen different

crops, by Labh Singh of vegetable seeds, by Nadi and Ganguli of rice and of the relation of catalase to viability, and work on the relation of depth of planting to germination by Singh and Alamare are noticed among others. Luthra and Chima's experiments to show that plumpness in grain is no advantage over shrivelled grain and that there is no advantage in grading wheat for size for seed purposes are mentioned, though this is contrary to general belief. Poor germination as the result of a thick seed-coat is referred to and the well-known methods of abrading, softening and other treatment by which this can be got over are described —methods which, in practice, can result in a great saving in the seed grain. Lyallpur experiments with Berseem bring out the usefulness of colour as an indication of viability, and of heavy fodder-yielding capacity. Purity in grain as affecting not only its market price but also the yield and quality of produce is referred to and the great prevalence of ear-cockle in wheat in the Punjab is mentioned as a serious trouble; it has, however, been shown to be easy of avoiding by the careful winnowing out of the galls. Loss of seed in the field after sowing which necessitates the use of heavy seed rates where much smaller rates can be used with advantage and the need for preventing such loss are brought out by certain Lyallpur experiments on the yield from varying seed rates of wheat. Vernalisation affords some scope in the acclimatization of promising exotic plants and varieties; distinct earliness was induced in sorghum and in mustard, in experiments conducted so far in Rohtak and Almora. Quality in seed or other produce as affected by manuring is dealt with, and the work of Viswanath on the effect of organic manures in enhancing the nutrient value of certain food grains, and the work in the Punjab and elsewhere on the influence of climatic and soil factors on the nutritive value of grass, especially in raising the protein, calcium and phosphatic contents are summarised. In superior varieties like improved types of cotton or wheat, the value of the higher quality is often offset by low yields; these consequently have to be raised by enabling the farmer to use larger quantities of manure and fertilisers. The work on the malting of food grains in Bangalore and in Coimbatore of ragi and sorghum respectively opens out a more remunerative use for produce; it is suggested that work should be started to see if many of the imported food preparations cannot be made out of local produce.

Arising directly out of the main theme of the address, a strong plea is put forward for the establishment by Government, of seed testing stations, where commercial seed can be examined and certified not merely for germination but for the several other requirements of good seed. The expenditure of more money on research and expansion and the formation of a committee of the Science Congress as an unofficial *liaison* agency between the public and the Government in respect of these problems of agricultural improvement, are other suggestions made.

A. K. Y.

PHYSIOLOGY

President: Dr. W. R. Aykroyd, M.D., Sc.D.

RICE

RICE is the staple food of about half the human race. In India the area under rice exceeds that under all other cereals put together. A poor rice eater in India consumes in addition to his staple cereal, which provides 80–90 per cent. of calories, only very small quantities of other foods such as pulses, vegetables, fruits and meat. Milk and milk products are taken in negligible quantities or not at all. Hence the nutritive value of the main ingredient in the diet is of great importance.

Rice is a poor source of fat, vitamin A, certain vitamins of the B_2 group and calcium. Its protein content is low compared with that of the other cereals but the biological value of its protein is comparatively high. Milled rice is poorer than under-milled rice in most important constituents. Parboiled rice, even when highly milled retains most of the anti-beriberi vitamin B_1, originally present in the unmilled grain. This is due to the fact that vitamin B_1 and other valuable food factors present in the outer layers diffuse into the grain during the process of parboiling and they escape removal when milling subsequently takes place. Washing of any kind of rice removes about 50 per cent. of vitamin B_1 and nicotinic acid.

The main reason why Beriberi is endemic only in the Northern Circars of the Madras Presidency is due to the fact that raw milled rice is consumed in these parts unlike parboiled rice in other parts.

Hand-pounded rice is superior to milled rice but the difference between the two is small when it is parboiled. The prevention of the spread of mills into areas where hand-pounded rice is still being used can be checked by legislation. The use of hand-pounded, or under-milled or parboiled rice may be encouraged by education and propaganda.

Milk and milk products can usefully supplement a rice diet and therefore every effort should be made to increase milk production. Partial substitution of rice by ragi (*Eleucine coracana*) improves poor rice diet. Special attention must be given to the increased production of green leafy vegetables which are rich in vitamin A and calcium. The fishing industry needs greater development with a view to providing fish liver oils, rich in vitamin A and D.

The state of nutrition of children who cannot afford milk can be improved by the administration of calcium-lactate.

PSYCHOLOGY

President: Dr. D. D. Shendarkar, Ph.D.

PSYCHOLOGY AND EDUCATIONAL RESEARCH

AFTER tracing briefly the growth of "Psychology in India", and emphasizing the importance of Psychology in Educational Research, Dr. Shendarkar observes that mere systematisation

or systematic study of psychological facts and theories and their scientific presentation would not be enough and that "a functional approach" should be recommended so that "the course in psychology be built round vital school issues and educational problems". Dr. Shendarkar complains that experiments have been worked out in psychological laboratories and that they have "little relation to learning in the school-room". The basic problem in Education is Learning. He then refers to the familiar "Mental Tests", "Examinations and Scholastic Tests", and examines how far Psychology can offer "vocational and educational guidance". In the concluding portion, Dr. Shendarkar refers to the importance of child-study and child-psychology, and remarks that undesirable habits like "thumb-sucking, nail-biting, ... nervousness, temper-tantrums, lying, stealing," etc., may be effectively eradicated if the Social Worker, the Psychologist, and the Psychiatrist combine their efforts. Dr. Shendarkar concludes with an expression of his feeling that "utilitarian study of Science, more especially psychology, has not kept pace with its academic study and what our country needs at the present juncture is applied knowledge more than pure science". It should be noted that Dr. Shendarkar wants a Central Institute of Education on the model of the Institute of Science at Bangalore, and that the office of the Commissioner for Education, Delhi, would be the most "suitable nucleus for such an institute".

A Central Psychology Institute like the one advocated by Dr. Shendarkar may find temporary or permanent employment to some now peradventure unemployed, and it is doubtful if such an Institute would make any original or substantial contributions to Pure and Applied Psychology. I do not believe that things move on in the Western Civilized Countries strictly after the application of the Psychological Intelligence tests or group-tests. Recruitment to Army, Navy, Air-Force, and the Public Services is made on various considerations, and it must be an extraordinarily rash assertion to make that such recruitment is governed by the verdict of the Experimental Psychologist, the Physical Institute, etc. That being so in the West, the land of Experimental Psychology *par excellence*, its cultivation on the Indian soil requires serious thinking.

Nor am I convinced about the validity of Dr. Shendarkar's advocacy of "applied knowledge at the present juncture more than pure science". For, application or no application, Pure Sciences must progress. That is the true spirit of Research. I would demand of any scientist to tell the average unsophisticated man what have been *actually the practical applications* of the Raman-Effect, and Sir C. V. Raman's researches in normal and abnormal scattering of light, and what applications are likely to be made in the near future. Looking at it psychologically, it is all a matter of special aptitude. Even in the land of its birth, the land of the Almighty Dollar, Behaviourism (old and new) is not exactly harnessed to practical American politics. Leaders of men, war-mongers, peace-makers, commercial magnates are not *conditioned into being or existence* by the practical applications of the principles of Behaviourism which is still a Pure Science. Untrammelled development of Psychology as a Pure Science is the first concern. It would then be time enough to develop Applied Psychology.

R. NAGARAJA SARMA.

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